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Attorney's Docket No. 017750-328

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	**Mail Stop Appeal Brief - Patents**
Richard Kirchofer et al.	Group Art Unit: 3662
Application No.: 09/902,095	Examiner: Gregory C Issing
Filed: July 11, 2001	Appeal No.: Unassigned
For: INTERFERENCE REJECTION GPS ANTENNA SYSTEM	Confirmation No.: 8095

APPEAL BRIEF

Mail Stop APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This appeal is from the decision of the Primary Examiner dated September 10, 2004 (Paper No./Mail Date 20040907), twice rejecting claims 1-73, which are reproduced as the Claims Appendix of this brief.

☐ A check covering the ☐ $250.00 (2402) ☐ $500.00 (1402) Government fee is filed herewith.

☒ Charge ☐ $250.00 (2402) ☒ $500.00 (1402) to Deposit Account Number 02-4800.

The Commissioner is hereby authorized to charge any appropriate fees under 37 C.F.R. §§1.16, 1.17, and 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 02-4800.

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I. Real Party in Interest

Lockheed Martin Corporation is the real party in interest, and is the assignee of the present application by virtue of the Assignment recorded in the United States Patent Office on July 11, 2001.

II. Related Appeals and Interferences

The Appellants' legal representative, or assignee, does not know of any other appeal or interferences which will affect or be directly affected by or have bearing on the Board's decision in the pending appeal.

III. Status of Claims

Claims 1-73 stand rejected at least twice and are the subject of this appeal.

IV. Status of Amendments

In response to a final rejection dated April 7, 2004, Appellants filed a Request for Continued Examination along with an Amendment and an Information Disclosure Statement[1] on August 9, 2004. On September 10, 2004, the Examiner issued a non-final Office Action rejecting all pending claims. No amendments have been filed in response to the September 10, 2004 Action.

V. Summary Claimed Subject Matter

The present invention, as generally described starting at paragraph 0034 on page 7 of Appellants' specification, is directed to methods and apparatuses for

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[1] Appellants note that the September 10, 2004 Office Action does not indicate whether the Examiner considered the Information Disclosure Statement dated August 9, 2004. It is respectfully requested that the Examiner consider this IDS, which cites a related application and several documents.

selectively receiving radio frequency (RF) signals which utilize an array of antenna elements including a center antenna for receiving the RF signals.

Various aspects of the invention are broadly encompassed by the appealed claims, which are now described:

A. Independent Claim 1

Claim 1 is directed to apparatus (e.g., see item 100 in Figures 1, 5 and 8) for selectively receiving radio frequency (RF) signals (e.g., see paragraph 0035). The apparatus includes an array of antenna elements for receiving the RF signals (e.g., see items 101 and 201a-201y in Figure 2, and paragraphs 0036-0041). The array includes a center antenna and a group of antenna elements surrounding the center antenna (e.g., see paragraph 0037, lines 15-26, and paragraph 0069).

The apparatus of claim 1 includes a navigational controller (e.g., see item 105 in Figures 1, 4, 5 and 7, and the description starting at paragraph 0048) for determining pointing vectors from coordinate information (e.g. see paragraph 0035, lines 3-4, and the description starting at paragraph 0048). Each of the determined pointing vectors points to a respective source of a received RF signal (e.g., see item 309 in Figure 4 and paragraphs 0048-0052).

Claim 1 also recites that the apparatus includes beam-forming electronics (e.g., see item 103 in Figures 1, 3, and item 103a-103m in Figures 5 and 6) connected to the array of antenna elements and the navigational controller (e.g., see Figure 1 and paragraph 0035, lines 8-12) for forming a reception lobe in the direction of each pointing vector (e.g., see the description starting at paragraph 0042, Figure 8 and paragraph 0060). A phase center for the array of antenna elements is maintained by adjusting the center antenna to a same phase shift for each of the reception lobes (e.g., see paragraph 0069).

As disclosed for example in the specification, The antenna array 101 of apparatus 100 comprises a plurality of antenna elements 201 for receiving the RF signals. An exemplary navigation controller 105, as shown with more detail in Figure 4 and described on page 13, paragraph 0048 of Appellants' specification, can include a receiver 401 for receiving RF signal transmissions that convey absolute

position information of the apparatus, and a navigation processor 405 for calculating a pointing vector based on coordinate information. For example, as described on page 14 of the specification, a receiver 401 (e.g., a GPS receiver) can transmit position information, in the form of pseudo and delta range information 407 (i.e., absolute position information), to the navigation processor 405. Based upon the position information 407, the navigation processor 405 is able to determine the location of a source transmitters of RF signals (e.g., a GPS satellites), and create pointing vectors 309, which indicate the direction of the source transmitters, to allow the beam-forming algorithm processor 305 to create reception lobes in the direction of each source of the RF signals. (See Figure 3, and the specification, ¶¶ 0042-0047.)

B. Independent Claim 31

A method for selectively receiving radio frequency (RF) signals is generally described in paragraph 0061 and shown in Figure 9. The method comprises the steps of receiving RF signals using an array of antenna elements (e.g., see item 901 in Figure 9) including a center antenna and a group of antenna elements surrounding said center antenna (e.g., see paragraph 0037, lines 15-26, and paragraph 0069), determining pointing vectors from coordinate information (e.g., see item 903 in Figure 9), each pointing vector pointing to a source of one of the received RF signals (e.g., see item 309 in Figure 4, and paragraphs 0048-0052), and forming a reception lobe in the direction of each pointing vector (e.g., see item 905 in Figure 9). Claim 31 recites that the center antenna is adjusted to a same phase shift for each reception lobe to maintain a phase center for the array of antenna elements (e.g., see paragraph 0069).

C. Independent Claim 37

Claim 37 is directed to an apparatus (e.g., see item 100 in Figures 1, 5 and 8) for selectively receiving radio frequency (RF) signals (e.g., see paragraph 0035). The apparatus includes an array of antenna elements for receiving RF signals (e.g., see items 101 and 201a-201y in Figure 2, and paragraphs 0036-0041). The array

includes a center antenna and a group of antenna elements surrounding the center antenna (e.g., see paragraph 0037, lines 15-26, and paragraph 0069).

Claim 37 recites that the apparatus includes a navigational controller (e.g., see item 105 in Figures 1, 4, 5 and 7, and the description starting at paragraph 0048), which includes an inertial measurement unit (IMU) for measuring changes in relative position of the apparatus and a processor (e.g., see the processor 405 in Figure 4) for determining pointing vectors based at least in part on coordinate information and the measured changes (e.g., see item 403 in Figure 4 and paragraph 0048). Each determined vector points to a source of a respective received RF signal (e.g., see item 309 in Figure 4 and paragraphs 0048-0052).

The apparatus also includes beam-forming electronics (e.g., see item 103 in Figures 1, 3, and item 103a-103m in Figures 5 and 6) connected to the array of antenna elements and the navigational controller (e.g., see Figure 1 and paragraph 0035, lines 8-12) for forming a reception lobe of the antenna array for each determined pointing vector (e.g., see the description starting at paragraph 0042, and Figure 8, and paragraph 0060). A phase center for the array of antenna elements is maintained by adjusting the center antenna to a same phase shift for each lobe (e.g., see paragraph 0069).

D. Independent Claim 67

Claim 67 is directed to a method for selectively receiving radio frequency (RF) signals. As described, for example, in paragraph 0061 and shown in Figure 10, the method includes the steps of receiving the RF signals (e.g., see item 1001 and the example starting at paragraph 0048) using an antenna array having a center antenna (e.g., see paragraph 0037, lines 15-26, and paragraph 0069), determining actual coordinate information from information conveyed by the RF signals (e.g., see item 1002 in Figure 10, item 401 in Figure 4 and paragraph 0048), sensing at least one change between an inertial reference frame and a reference frame of the antenna (e.g., see item 1005 in Figure 10 and 0051), determining relative coordinate information based on the sensed changes (e.g., see item 1007 and paragraph 0051), determining pointing vectors from the actual and the relative coordinate information,

each said pointing vector pointing in the direction of a source one of the RF signals(e.g., see item 1009 and paragraph 0052), and for each pointing vector, forming a reception lobe in a direction of the pointing vector (e.g., see item 905 in Figure 9) , wherein the center antenna is adjusted to a same phase shift for each reception lobe to maintain a phase center for the antenna (e.g., see paragraph 0069).

VI. Grounds of Rejection to be Reviewed on Appeal

The single grounds of rejection for review is the rejection of claims 1-73 under 35 U.S.C. §103 as allegedly being unpatentable over Dixon (U.S. Patent No. 6,023,242) in view of Greenspan (U.S. Patent No. 5,917,446), alleged admissions of prior art, and Feuerstein et al. (U.S. Patent No. 6,178,333).

VII. Argument

A. The Rejection of Independent Claims 1, 31, 37, and 67 over the Dixon, Greenspan, Feuerstein et al. Patents and Alleged Admissions of Prior Art Fails to Establish a *Prima Facie* case of Obviousness

A Common Distinction Recited in Independent Claims 1, 31, 37, and 67

Each of independent claims 1, 31, 37 and 67 recites, among other features, that a center antenna element of an antenna array is adjusted to the same phase shift for each of the lobes to maintain a phase center for the antenna array. None of the Dixon, Greenspan, and Feuerstein et al. patents teaches this feature. Furthermore, there are no admissions in Appellants' specification that this feature constitutes prior art, as alleged by the Examiner. Nor is there any teaching or suggestion within these documents that would have led one of ordinary skill in the art to modify the systems of Dixon and Greenspan to arrive at the claimed combinations including the feature of a center antenna element of an antenna array is adjusted to the same phase shift for each of the lobes to maintain a phase center for the antenna array.

On page 2 of the Action, the Examiner essentially asserts that the Dixon and Greenspan documents teach all claimed features except for a center antenna

element of an antenna array being adjusted to the same phase shift for each of the lobes to maintain a phase center for the antenna array. The Examiner, therefore, applies a description in the Feuerstein et al. patent of maintaining a common phase center on a panel of an antenna for each of the beams radiating therefrom (see, column 5, lines 19-52) and alleges that it would have been obvious or inherent to provide a common phase center. Realizing that the Feuerstein et al. document fails to teach the claimed feature of a center antenna element of an antenna array, and a center antenna being adjusted to the same phase shift for each of the lobes to maintain a phase center for the antenna array, the Examiner resorts to a baseless allegation that paragraph 0069 of Appellants' disclosure is an admission of prior art (see, page 2, lines 16-19 of Section 2 and page 3, lines 10-12). The Examiner's tenuous position is that "if an array comprises a center element, it would be required to have a phase shift that is common to all the beams, otherwise, it would not share a common center" (see page 3, lines 1-3). Appellants submit that this allegation is predicated on an improper characterization and use of Appellants specification and not on evidence from the prior art or on sound technical reasoning required for showing inherency. These points are now discussed in detail.

<u>The Examiner's Reliance on Paragraph 0069 of Appellants' Specification is Improper</u>

The Examiner improperly asserts that Applicants' specification admits claimed features to be prior art. Specifically, the Examiner makes the following statements:

> Additionally, the provision of a common phase center for each of the beams is obvious, if not inherent, in view of the requirement of such for processing GPS carrier phase measurements, see applicants' specification [0069]. (Page 2, lines 16-19.)
>
> Secondly, the specification also makes clear that the technique of applying the same phase shift to the center element of an array for each of multiple beams maintains a constant phase center which is a requirement for accurate and precise carrier phase measurements. (Page 3, lines 10-12).

Applicants take exception to these characterizations by the Examiner and submit that any such allegation amounts to an improper use of Appellants' own disclosure against them. First of all, there is no "admissions of prior art" made in paragraph

0069. Nor does Appellants' description of conventional antennas in paragraph 0037 (see lines 2-4) constitute an admission of prior art with respect to the claimed feature of a phase center for the array of antenna elements being maintained by adjusting the center antenna to a same phase shift for each of the reception lobes. Rather, Appellants submit that the Examiner has taken the description of Applicants' technique for maintaining a constant phase center in an array including a center antenna, as disclosed in paragraph 0069 of Appellants' specification, and has twisted its characterization from one of Applicants' invention description to one of alleged "admissions of prior art." To reject Appellants' claims, the Examiner uses this mischaracterization to form his conclusory allegation of inherency with respect to the proposed combination of the Feuerstein et al., Dixon and Greenspan patents.

<u>The Feuerstein et al., Dixon and Greenspan Patents, and Appellants' Description of Conventional Antenna Arrays, Fail to Teach or Suggest All Claimed Features</u>

The Feuerstein et al. patent, which the Examiner relies on for teaching "a common phase center in order to avoid destructive combining of the signals ..." (see the sentence spanning pages 2 to 3), does not teach or suggest the claim 1, 31, 37 and 67 combinations including the specific feature of a phase center for the array of antenna elements is <u>maintained by adjusting the center antenna to a same phase shift for each of the reception lobes</u>. Rather, Feuerstein et al. describes using a "Butler matrix or other circuitry" (column 5 lines 26-30) to form a beams such that "the phase centers of each of the antenna beams corresponding to the inputs of the beam forming matrix are the same, i.e., centered horizontally in the antenna panel face as illustrated in Figure 4" (column 5, lines 45-48). While this description in Feuerstein et al. may teach a horizontal phase center in the antenna panel <u>face</u>, no antenna element is located at the common center.

With respect the above obviousness/inherency allegation by the Examiner concerning a common phase center, even if one were to consider *arguendo* that one of ordinary skill in the art would have been motivated to provide a common phase center in the Dixon or Greenspan antenna array as taught in the Feuerstein et al.

patent, such hypothetical modification would not have taught, suggested or necessarily resulted in and apparatus or method as claimed, which includes *inter alia* a phase center for the array of antenna elements being maintained by adjusting the center antenna to a same phase shift for each of the reception lobes. The inventor has confirmed to the undersigned that the Butler matrix described in Feuerstein et al. would not necessarily maintain the phase center by adjusting the center antenna to a same phase shift for each of the reception lobes. The inventor further confirmed that while the use of a Butler matrix can result in a common phase center in a face of an antenna panel, the common center itself often moves with beam motion. In contrast, the independent claims require that a center antenna element and *maintaining* (i.e., fixing) the phase center at the center antenna by way of adjusting a center antenna to a same phase shift for each of the reception lobes. Absent benefit of the use of Appellants' own disclosure, such feature would not have been taught or suggested by any combination of the Feuerstein et al., Dixon and Greenspan patents.

Appellants' technique of adjusting a center antenna to a same phase shift for each reception lobe is not a trivial claim recitation. This technique, which forces a phase center to exist at the unique point at which a center antenna element is located, facilitates taking extremely accurate and precise carrier phase measurements, especially in environments in which beams are tracking moving RF sources. Such a maintained phase center provides for higher quality RF input to a receiver. High quality input, in turn, allows for optimum signal detection, signal correlation, and thus improvements in carrier to noise ratio. These increased capabilities also lead to enhancements in a receiver's capacity to operate in code phase mode or carrier phase mode, enhanced common mode rejection, and more accurate velocity output. The present invention also improves system performance as a result of the increase in received RF signal power, which enhances multipath rejection, and the constant antenna phase center, which provides a fixed lever arm geometry. Both of these features would be essential for high precision navigation and control.

In the last paragraph of page 16 of Appellants' August 9, 2004 Amendment, the Examiner was requested to produce a citation supporting his allegation of an

inherency with respect to a phase center necessarily being common to a center antenna element. To date, no reference has been supplied. Moreover, the Examiner does not provide any sound technical reasoning that would support any allegation that the beam-forming matrix taught in Feuerstein et al. would necessarily result in a phase center for the array of antenna elements being maintained by adjusting the center antenna to a same phase shift for each of the reception lobes.

As pointed out above, none of Greenspan, Dixon, and Feuerstein et al. teach or suggest a center antenna, much less that *a phase center for the array of antenna elements being maintaining by adjusting the center antenna to a same phase shift for each of the reception lobes* as claimed. Also as pointed out above, the techniques described in Feuerstein et al. would not necessarily result in the claimed feature of *a phase center for the array of antenna elements being maintaining by adjusting the center antenna to a same phase shift for each of the reception lobes*, as set forth in independent claim 1 and similarly recited in independent claims 31, 37 and 67. Applicants respectfully submit that allegations in the rejection are not based in fact, and thus cannot constitute a basis for establish a *prima facie* case of obviousness.

The conclusion reached by the Examiner at page 3, lines 13-14 of the Action: "Thus, the antenna arrangement as well as the provision of a constant phase center is disclosed by applicants as to be respectively within the skill of an artisan and required," absent the Examiner's inappropriate application of Appellants' own teachings, is not substantiated by any evidence sufficient for establishing a *prima facie* case of obviousness. See MPEP § 2143, which sets forth three required criteria establishing a *prima facie* case of obviousness, one of which requires that the prior art references when combined must teach or suggest all the claim limitations. Also see MPEP § 2143.01, which instructs that statements such as "within the ordinary skill in the art" must be accompanied some objective reasoning to combine the teachings of the references to establish a *prima facie* case.

For the foregoing reasons, one of ordinary skill in the art would not have been led to the combinations of features recited in claims 1, 31, 37 and 67, based on the teachings of Feuerstein et al., Dixon, Greenspan, and the description of conventional

antennas in paragraph 0037 of Appellants' specification, without the benefit of Appellants' own disclosure. Of course, use of what only Appellants have taught to show obviousness is impermissible. As such, the rejection is improper and should be reversed.

Finally, the Examiner makes the following statements with respect to novelty:

> Furthermore, there is no indication of the alleged novelty of such a requirement in the instant application as there is no showing in the drawing and the applicants' only recently added such feature to the abstract. The statement that Figure 13 shows the claimed feature is not convincing and applicants have failed to show where in Figure 13 the alleged novelty lies. (See, page 3, lines 17-20.)

It is respectfully submitted, however, that whether something described in the specification also should be set forth in the abstract or shown in drawings concerns Patent Office rules, which are petitionable matters, and thus not appealable matters before the Board.[2] Furthermore, Appellants request that the Examiner provide an authority supporting his apparent requirement that a feature must be present in an abstract or drawing before it can be considered novel.

Dependent Claims 2 and 38

Claims 2 and 38 respectively depend from claims 1 and 37. Hence, the rejection of these claims should be reversed at least for the reasons pointed out above. Additionally, these claims recite that the elements of the array comprise dual-frequency patch elements. None of the Dixon, Greenspan, and Feuerstein et al. patents teach or suggest this claimed feature. Thus, any combination of these patents also would not teach or suggest the combinations of additional features recited in claims 2 and 38.

The Remaining Claims

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[2] It should be noted here that Appellants amended the Abstract in response to the Examiner's comments in the final Office Action dated April 7, 2004 (see the last sentence on page 3). It is also noted that the subject matter in paragraph 0069 is part of the description of the example shown in Figure 13.

The rejection of dependent claims 3-30, 32-36, 39-66 and 68-73 should be reversed, if for no other reasons than they each depend from one of independent claims 1, 31, 37 and 67. In addition, the dependent claims recite combinations including additional features not taught or suggested by the Dixon, Greenspan, and Feuerstein et al. patents.

VIII. Conclusion

For all the foregoing reasons, Appellants respectfully submit that the rejection under Section 103 of claims 1-73 is in error because the Examiner has failed to establish a *prima facie* case of obviousness. Accordingly, the rejection of all claims should be reversed.

Respectfully submitted,

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CLAIMS APPENDIX

The Appealed Claims

Claim 1. Apparatus for selectively receiving radio frequency (RF) signals, comprising:

an array of antenna elements for receiving the RF signals, said array including a center antenna and a group of antenna elements surrounding the center antenna;

a navigational controller for determining pointing vectors, each vector pointing to a respective source of a received RF signal, from coordinate information; and

beam-forming electronics connected to the array of antenna elements and the navigational controller for forming a reception lobe in the direction of each pointing vector, wherein a phase center for the array of antenna elements is maintained by adjusting the center antenna to a same phase shift for each of the reception lobes.

Claim 2. The apparatus of claim 1, wherein the elements of the array comprise dual-frequency patch elements.

Claim 3. The apparatus of claim 1, wherein the beam-forming electronics form the reception lobes by adjusting the phase of the elements of the array.

Claim 4. The apparatus of claim 1, further comprising an antenna output from the beam-forming electronics.

Claim 5. The apparatus of claim 1, wherein the elements of the array are arranged in a symmetric configuration.

Claim 6. The apparatus of claim 1, wherein the elements of the array are arranged in a radially symmetric configuration.

Claim 7. The apparatus of claim 1, wherein the RF signals comprise signals from at least one global positioning system (GPS) satellite and the pointing vector comprises a satellite pointing vector.

Claim 8. The apparatus of claim 1, wherein the reception lobes have a width of 25 degrees or less.

Claim 9. The apparatus of claim 1, wherein said beam-forming electronics comprises:

at least one phase shifter connected to the array of antenna elements for shifting the phase of the received RF signal; and

a beam-forming algorithm processor connected to the at least one phase shifter and the navigational controller for calculating an amount by which the at least one phase shifter shifts the received RF signals in response to the pointing vector.

Claim 10. The apparatus of claim 9, wherein the at least one phase shifter comprises an array of phase shifters.

Claim 11. The apparatus of claim 10, wherein said beam-forming electronics comprises a means for summing outputs of each phase shifter of the array of phase shifters.

Claim 12. The apparatus of claim 11, further comprising an antenna output from said means for summing outputs of each phase shifter, of the beam-forming electronics.

Claim 13. The apparatus of claim 9, wherein the output of the phase shifters constructively amplifies selectively received RF signals by an amplification factor by aligning selective reception lobes of each element of the array of antenna elements, while interference signals from undesired sources are combined by the phase shifters in a random manner, such that the interference signals experience essentially no amplification.

Claim 14. The apparatus of claim 13, wherein the constructive amplification amplifies desired, selectively received RF signals by at least 12 dB.

Claim 15. The apparatus of claim 13, wherein the interference signals have a strength of -30 dB.

Claim 16. The apparatus of claim 1, wherein the navigational controller comprises:

a receiver for receiving RF signal transmissions conveying absolute position information of the apparatus;

an inertial measurement unit (IMU) for measuring changes in relative position of the apparatus; and

a navigation processor connected to the receiver, the IMU, and the beam-forming algorithm processor for receiving absolute and relative position

information from the receiver and the IMU, and calculating the pointing vector from the absolute and relative position information, and transmitting the pointing vector to the beam-forming algorithm processor.

Claim 17. The apparatus of claim 16, wherein the receiver comprises a GPS receiver.

Claim 18. The apparatus of claim 17, wherein the GPS receiver contains satellite almanac information comprising location information of satellites.

Claim 19. The apparatus of claim 16, wherein the IMU comprises a vibrational sensor.

Claim 20. The apparatus of claim 16, wherein the IMU comprises a gyroscopic sensor.

Claim 21. The apparatus of claim 20, wherein the gyroscopic sensor comprises a laser gyroscopic sensor.

Claim 22. The apparatus of claim 16, wherein the IMU comprises an accelerometer.

Claim 23. The apparatus of claim 16, wherein the IMU is a micro-machined device.

Claim 24. The apparatus of claim 16, wherein the relative position information comprises a change in velocity.

Claim 25. The apparatus of claim 16, wherein the relative position information comprises a change in angle.

Claim 26. The apparatus of claim 1, wherein the navigation processor is connected to a host.

Claim 27. The apparatus of claim 26, wherein the connection with the host provides input and output (I/O) communications between the navigation processor and the host.

Claim 28. The apparatus of claim 1, wherein the pointing vector is updated using a pre-determined refresh rate.

Claim 29. The apparatus of claim 28, wherein refresh rate is 200 Hz.

Claim 30. The apparatus of claim 28, wherein the refresh rate corresponds to an update rate of the reception lobes.

Claim 31. A method for selectively receiving radio frequency (RF) signals, comprising the steps of:

receiving RF signals using an array of antenna elements including a center antenna and a group of antenna elements surrounding said center antenna;

determining pointing vectors from coordinate information, each pointing vector pointing to a source of one of the received RF signals; and

forming a reception lobe in the direction of each pointing vector, wherein the center antenna is adjusted to a same phase shift for each reception lobe to maintain a phase center for the array of antenna elements.

Claim 32. The method of claim 31, wherein the step of determining pointing vectors determines a satellite pointing vectors.

Claim 33. The method of claim 31, wherein the step of determining is accomplished using actual coordinate information.

Claim 34. The method of claim 31, wherein the step of determining is accomplished using relative coordinate information.

Claim 35. The method of claim 31, wherein the step of forming the reception lobes is accomplished by shifting the phase of an RF signal received in the step of receiving.

Claim 36. The method of claim 31, further comprising the steps of:

shifting the phase of signals from antenna elements in the array to obtain phase-shifted signals; and

summing the phase-shifted signals obtained in the step of shifting in a manner such that desired RF signals in the direction of each pointing vector are constructively summed, providing an effective amplification of the desired RF

signals, while interference RF signals not in the direction of the pointing vectors are not effectively amplified due to random shifting of the interference RF signals.

Claim 37. Apparatus for selectively receiving radio frequency (RF) signals, comprising:

an array of antenna elements for receiving RF signals, said array including a center antenna and a group of antenna elements surrounding the center antenna;

a navigational controller comprising:

an inertial measurement unit (IMU) for measuring changes in relative position of the apparatus; and

a processor for determining pointing vectors based at least in part on coordinate information and the measured changes, wherein each said vector points to a source of a respective received RF signal; and

beam-forming electronics connected to the array of antenna elements and the navigational controller for forming a reception lobe of the antenna array for each determined pointing vector, wherein a phase center for the array of antenna elements is maintained by adjusting the center antenna to a same phase shift for each lobe.

Claim 38. The apparatus of claim 37, wherein the elements of the array comprise dual-frequency patch elements.

Claim 39. The apparatus of claim 37, wherein the beam-forming electronics form the reception lobes by adjusting the phase of the elements of the array.

Claim 40. The apparatus of claim 37, further comprising an antenna output from the beam-forming electronics.

Claim 41. The apparatus of claim 37, wherein the elements of the array are arranged in a symmetric configuration.

Claim 42. The apparatus of claim 37, wherein the elements of the array are arranged in a radially symmetric configuration.

Claim 43. The apparatus of claim 37, wherein the RF signals comprise signals from at least one global positioning system (GPS) satellite and the pointing vectors comprise a satellite pointing vectors.

Claim 44. The apparatus of claim 37, wherein each reception lobe has a width of 25 degrees or less.

Claim 45. The apparatus of claim 37, wherein said beam-forming electronics comprises:

at least one phase shifter connected to the array of antenna elements for shifting the phase of the received RF signals; and

a beam-forming algorithm processor connected to the at least one phase shifter and the navigational controller for calculating an amount by which the at least one phase shifter shifts the received RF signals in response to the pointing vector.

Claim 46. The apparatus of claim 45, wherein the at least one phase shifter comprises an array of phase shifters.

Claim 47. The apparatus of claim 46, wherein said beam-forming electronics comprises a means for summing outputs of each phase shifter of the array of phase shifters.

Claim 48. The apparatus of claim 47, further comprising an antenna output from said means for summing outputs of each phase shifter, of the beam-forming electronics.

Claim 49. The apparatus of claim 45, wherein the output of the phase shifters constructively amplifies selectively received RF signals by an amplification factor by aligning selective reception lobes of each element of the array of antenna elements, while interference signals from undesired sources are combined by the phase shifters in a random manner, such that the interference signals experience essentially no amplification.

Claim 50. The apparatus of claim 49, wherein the constructive amplification amplifies desired, selectively received RF signals by at least 12 dB.

Claim 51. The apparatus of claim 49, wherein the interference signals have a strength of -30 dB.

Claim 52. The apparatus of claim 37, wherein the navigational controller further comprises a receiver for receiving RF signal transmissions conveying absolute position information of the apparatus,

Claim 53. The apparatus of claim 52, wherein the navigation processor is connected to the receiver and the IMU, determines a pointing vector by way of a calculation based on the actual and relative position information, and transmits the pointing vector to the beam-forming algorithm processor.

Claim 54. The apparatus of claim 52, wherein the receiver comprises a GPS receiver.

Claim 55. The apparatus of claim 54, wherein the GPS receiver contains satellite almanac information comprising location information of satellites.

Claim 56. The apparatus of claim 37, wherein the IMU comprises a vibrational sensor.

Claim 57. The apparatus of claim 37, wherein the IMU comprises a gyroscopic sensor.

Claim 58. The apparatus of claim 57, wherein the gyroscopic sensor comprises a laser gyroscopic sensor.

Claim 59. The apparatus of claim 37, wherein the IMU comprises an accelerometer.

Claim 60. The apparatus of claim 37, wherein the IMU is a micro-machined device.

Claim 61. The apparatus of claim 37, wherein the relative position information comprises a change in velocity.

Claim 62. The apparatus of claim 37, wherein the relative position information comprises a change in angle.

Claim 63. The apparatus of claim 37, wherein the navigation processor is connected to a host.

Claim 64. The apparatus of claim 63, wherein the connection with the host provides input and output (I/O) communications between the navigation processor and the host.

Claim 65. The apparatus of claim 37, wherein the pointing vector is updated using a pre-determined refresh rate.

Claim 66. The apparatus of claim 65, wherein refresh rate is 200 Hz.

Claim 67. A method for selectively receiving radio frequency (RF) signals, comprising the steps of:

receiving the RF signals using an antenna array having a center antenna;

determining actual coordinate information from information conveyed by the RF signals;

sensing at least one change between an inertial reference frame and a reference frame of the antenna;

determining relative coordinate information based on the sensed changes;

determining pointing vectors from the actual and the relative coordinate information, each said pointing vector pointing in the direction of a source one of the RF signals; and

for each pointing vector, forming a reception lobe in a direction of the pointing vector, wherein the center antenna is adjusted to a same phase shift for each reception lobe to maintain a phase center for the antenna.

Claim 68. The method of claim 67, wherein the step of determining ~~a~~ pointing vectors determines a satellite pointing vectors.

Claim 69. The method of claim 67, wherein the received RF signals are transmitted from a global positioning system (GPS) satellite.

Claim 70. The method of claim 67, wherein the step of forming the reception lobe is accomplished by shifting the phase of an RF signal received in the step of receiving.

Claim 71. The method of claim 67, wherein a pointing vector is determined for different sources of the received RF signals, and the step of forming a reception lobe includes forming a reception lobe for each of the different RF sources.

Claim 71. The method of claim 71, wherein each of the plurality of RF signals sources corresponds to a different GPS satellite.

Claim 73. The method of claim 67, further comprising the steps of:

shifting the phase of signals from antenna elements in the array to obtain phase-shifted signals; and

summing the phase-shifted signals obtained in the step of shifting in a manner such that desired RF signals in the direction of each pointing vector are constructively summed, providing an effective amplification of the desired RF signals, while interference RF signals not in the direction of the pointing vectors are not effectively amplified due to random shifting of the interference RF signals.